Abstract

EUROPA FOCUS GROUP

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Status of the Europa Orbiter Mission

NASA has announced an opportunity to conduct scientific investigations on its planned Europa Orbiter (EUO) mission. The science objectives of this mission are to:

- Determine the presence or absence of a subsurface ocean;
- Characterize the three-dimensional distribution of any subsurface liquid water and its overlying ice layers; and
- Understand the formation of surface features, including sites of recent or current activity, and identify candidate landing sites for future lander missions.

Scientific proposals have been solicited, submitted, and evaluated for investigations involving remote sensing, radar sounding, gravity, and magnetic field. Selection of the flight payload is still pending. Although originally announced as a 2003 launch, issues involving launch vehicle availability, technology development in the area of radiation-hardened electronics, and evolving fiscal constraints have led to a slip in the launch date. Substantial mass and cost growth has been experienced over the past year due to reductions in mission risk, improved understanding of mission requirements, more realistic definition of advanced technology components, and stretchout of the program due to launch delay. Options currently under consideration include direct trajectories in either February 2007 or March 2008 with Europa orbit insertion in 2011 or 2012, respectively, and a March 2007 gravity-assist trajectory with Europa orbit insertion in early 2013. The primary mission is still planned as a 30-day period in low (100 – 300 km altitude) Europa orbit. Planetary protection considerations may limit the orbit inclination to a maximum of 45° in order to maintain long-term orbit stability. An operating duty cycle having the spacecraft nadir pointed for gathering remote sensing and radar data for roughly 50% of the time and Earth pointed for data downlinking and Doppler tracking the remaining 50% of the time is envisioned. Roughly 10 Gb of science data can be returned over the course of the 30-day mission. The existence of a current liquid ocean can be determined by measuring Europa's k_2 and h_2 Love numbers resulting from Jupiter's time-varying tide via gravimetry and altimetry to an accuracy of ~1 m and by observing the

magnetic field of Europa to an accuracy of ≤1 nT over time. Radar sounding can allow characterization of the ice and any geophysical interfaces down to depths of up to 10 km depending on the actual characteristics of the ice, with depth resolution of 100 m or 10% of depth, whichever is greater. Acquisition of a global-scale radar sounding map is expected with spatial resolution of 6 km or better along track, ~20 km across track, and ground track spacing of <270 km. Global-scale imaging coverage at a spatial resolution of ~300 m/pixel, possibly in two or more colors, is also anticipated. Detailed measurements of surface morphology at selected sites of interest can be obtained using high-resolution imagery (~20 m/pixel) and altimetry (~100-m spot size). The spacecraft is expected to absorb a total radiation dose of about 10 Mrad (Si) (inside the bus, i.e., behind 40 mils of Al) by the end of the nominal mission.